

**REMARKS**

Claims 1-29 are all the claims pending in the application. Claims 1-6, 8, 12-16, 21, 22 and 26-29 presently stand rejected. Claims 7, 9-11, 17-20 and 23-25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Claim 21 is rejected under 35 U.S.C. § 112, second paragraph.

Claims 1-4, 22 and 27-29 are rejected under 35 U.S.C. § 102(b) as being anticipated by Nakazawa et al. (WO 97/32728).

Claims 16 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakazawa et al. (WO 97/32728) in view of Araki (USP 6,312,077).

Claims 5, 6 and 8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakazawa et al. (WO 97/32728) in view of Katsurai et al. (USP 4,679,053).

Claims 12-15 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakazawa et al. (WO 97/32728) in view of Araki (USP 6,312,077) and Katsurai et al. (USP 4,679,053).

For the following reasons, Applicant respectfully traverses the rejections and requests favorable disposition of the claims.

***Argument***

In regard to the §102 rejection asserted against claims 1-4, 22 and 27-29, as being anticipated by Nakazawa et al. (WO 97/32728), Applicant respectfully submits that Nakazawa et al. fails to teach or suggest at least a head driver comprising a bias power source, which applies *a bias voltage* having a predetermined potential to the common electrode of each piezoelectric element, as expressly recited in the claims.

In particular, the invention disclosed and claimed in the present application is directed to an apparatus and method for driving a print head in an ink jet printer wherein the potential difference between electrodes of each piezoelectric device is reduced, consequently reducing a voltage drop in each piezoelectric device when the devices are discharged. (See page 3, lines 8-11). As described, “by directly applying the bias voltage to the common electrode of the piezoelectric element from the bias power source, the potential of the piezoelectric element is held at the bias voltage. Consequently, since the voltage applied between both electrodes of the piezoelectric element becomes relatively low, consumed power is reduced.” (Page 3, line 25 through page 4, line 4).

Furthermore, since the predetermined bias voltage is applied to the common electrode of the piezoelectric device, “leak current is reduced even if natural discharge of the piezoelectric element occurs, so that the voltage drop is reduced.” (Page 4, lines 6-8). Additionally, as a result of the bias voltage applied to the common electrode of the piezoelectric device, steep voltage variations can be avoided when the piezoelectric device is charged, thereby eliminating erroneous operation of the piezoelectric device. (Page 4, lines 8-11).

In accordance with the invention disclosed in the specification, independent claim 1 recites, *inter alia*;

a bias power source, which applies a bias voltage having a predetermined potential to the common electrode of each piezoelectric element.

Nakazawa et al., in comparison, discloses a control method for an ink jet printer “whereby clogging of nozzles by ink that has become more viscous in the area of the nozzles is prevented.” (Col. 1, lines 8-10). Specifically, Nakazawa et al. discloses a method whereby:

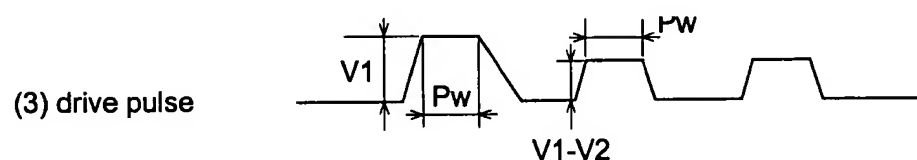
The drive voltage selector 130 selects the drive pulse applied to the pressure generating means of the ink jet head 30. The drive pulse is either a high amplitude drive pulse causing ink drop ejecting, or a low amplitude drive pulse for mobilizing ink inside the nozzles without ejecting ink drops. The drive voltage selector 130 controls the ink jet head driver 190 to apply a high amplitude drive pulse to any nozzle operated to eject ink for recording according to the drive signal output by the drive signal generator 180, and to apply a low amplitude drive pulse to all other nozzles.

In other words, the drive circuit of Nakazawa et al. delivers a high amplitude drive pulse to a pressure generating device, such as a piezoelectric device, when it is desired that ink be ejected from a corresponding print head nozzle. Further, the drive circuit delivers a low amplitude drive pulse to all other nozzles from which it is desired that ink not be ejected but for which it is desired that the ink within the nozzle be mixed.

The grounds of rejection assert that Nakazawa et al. discloses the recited bias power source as driver 190a of Fig. 7. Applicant respectfully disagrees. Although Nakazawa et al. does disclose that driver 190a *drives the common electrode* of the ink jet head (see col. 9, lines 14-16), Nakazawa et al. does not disclose that the drive signal delivered by driver 190a is a *bias voltage*. In fact, the passage cited by the Examiner specifically discloses that the voltage delivered by driver 190a is not a bias voltage. In particular, at col. 9, lines 18-20, Nakazawa et al. discloses:

[d]river 190a switches the voltage applied to the common electrode terminal 22 between a voltage V1 and the ground (0 V); driver 190b switches the voltage applied to the segment electrode 10 between a second voltage V2 and the ground (0 V). Note that V1 is greater than V2, and two different voltages, V1 and V1-V2, (or three voltages if 0 V is included) can be applied to the opposing electrode gap (between the diaphragm 8 and segment electrode 10).

The voltage delivered by driver 190a is, thus, the “high amplitude drive pulse causing ink drop ejecting” and the voltage delivered by driver 190b is the “low amplitude drive pulse for mobilizing ink inside the nozzles”, as mentioned above and illustrated in Fig. 9, reproduced below.



**Figure 9**

As is clear from Fig. 9, the circuit 190a applies the voltage  $V1$  whenever the piezoelectric element is driven, i.e., during both ink ejection and meniscus vibration. The Examiner is associating the voltage  $V1$  with the claimed bias voltage. However, the respective independent claims recite that a drive signal is selectively applied to *only* a piezoelectric element to be driven to eject an ink droplet, while a bias voltage is applied to all the piezoelectric elements, e.g., common electrode. If the voltage  $V1$  is applied to all the piezoelectric elements as claimed, the elements must be continuously driven based on the above operation principle. Accordingly,  $V1$  is not the claimed bias voltage.

Based on the discussion above, since all claims 1-29 include the feature of applying a bias voltage to the common electrode of each piezoelectric element and, further, because the grounds of rejection for all claims rely on Nakazawa et al. for disclosing this feature, which as described above it does not, Applicant submits that claims 1-29, as presently presented, are all patentable over the cited prior art.

AMENDMENT UNDER 37 C.F.R. § 1.111  
U.S. Appln. No. 10/092,949

In regard to the rejection of claim 21 under 35 U.S.C. §112, second paragraph, Applicant has amended the claim as set forth above. Applicant submits that claim 21 satisfies all the requirements of 35 U.S.C. § 112.

***Conclusion***

In view of the above amendments and remarks, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

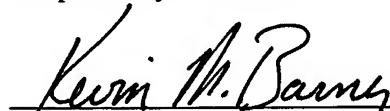
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